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Approved For Release 2005/06/08 : CIA-RDP78B05171A000800070016-8

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24 June 1969

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MEMORANDUM FOR: Chief, Development & Engineering Division, TSSG/NPIC
SUBJECT : Dual Gamma Processing as Evaluated by EL/ESD
REFERENCE : Memorandum, Subject: Dual Gamma Processing, Dated 8 May
1969, [redacted] (ESD/EL)

1. The reference presents an evaluation of the dual gamma film developing technique. The primary conclusion reported is: "If there is a reason for adopting dual gamma processing, it is not evident on sensitometric grounds except for a very small gain in the toe region of the curve." This conclusion is erroneous and the arguments supporting it are ambiguous. This memorandum attempts to clarify the situation.

2. The many advantages of the dual gamma process include better processing control, increased flexibility for changing chemistry for abnormally exposed film, improved O-N definition, and one step processing. These assets notwithstanding, the primary advantage does in fact result directly from the improved sensitometric characteristics provided by the dual gamma process. Consider the sensitometric curves of dual gamma process and its predecessor. Over-exposure means that energy above a certain level results in an negative image which is too dark, and which in turn produces a positive of poor quality when printed. Experience and theory show that if the negative film can be made to record energy above this level, so that the negative is not over-exposed (too dark) in this region, the negative film will have increased utility, i.e., its exposure range will have been expanded. This is what the dual gamma process provides.

3. As an illustration, consider the curves in figure 1. The single gamma curve represents the before dual gamma situation; exposures producing densities above d_1 were of little value and not to be desired. Consequently, objects having luminances above E_1 were not recorded properly. The dual gamma curve shows that exposure E_1 produces a density well below d_1 in fact, exposures up to E_2 are now going to be reproduced satisfactorily. In effect, the useful exposure range has been increased or in equivalent terms, the exposure latitude of the negative has been extended. This means tone reproduction will improve and the margin for exposure errors has been increased.

4. The statements in the reference arguing for application of the same criteria to both processes are logically and technically inaccurate. Logically, one might expect different criteria for different processes designed to achieve different objectives. Technically, sensitometrically, it is essential

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to modify the parameters as the process is modified. For example, the ASA standard methods and criteria for measuring film contrast, speed, and density have undergone modifications as technology evolved. It is particularly important to note that the decision to "shift to the right" was indeed arbitrary. Contrary to the objections in the reference, this action was better than none at all since it capitalized on a main advantage of the process, i.e., increased exposure latitude. Lacking input from the community, this was a reasonable action. Studies are underway to establish the actual figures more precisely.

5. The statements relating visibility to detail and modulation in paragraph 5 of the reference are technically incorrect and in addition the points addressed are not germane. These factors should be judged from the positive print. The lower gradient in the dual gamma shoulder may well improve quality from a noise and contrast point of view in terms of the dupe positive quality.

6. The reference, taken at face value, could be misleading and cause concern where none is justified.

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SINGLE VS. DUAL GAMMA EXPOSURE RANGE

DUAL GAMMA
SINGLE GAMMA

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| DOC. NO. [redacted] | | LOGGED BY |
| DOC. DATE 24 June 1969 | | |
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